

Technology**The Role of Education and ICT in Economy****Mediha Tezcan**

Anadolu University

Knowledge and technological innovation play a crucial role in economic activities in parallel with the technological infrastructure recognized by managers, scientists, and engineers, together with the related telecommunications, information systems, environment, microelectronics machinery and computer-based transportation. As it could be easily seen, technical progress has direct effects only on production. Through process or product innovation, it is evident that to maintain a kind of feedback on education and human capital formation is the natural result of the investment inputs closely connected with the scholastic fashion. Education and technological change are major determinant of economic, cultural, political, social, demographic changes. It must be borne in mind that considering the global aspect of the economic system, one should emphasize the importance of the inclusion of information and communication technologies (ICT) in education, which naturally result in the productivity of education outputs. In parallel with the close relationship between human capital and social capital, which are closely connected with each other and at the same time trigger each other. All of them aim at the well being of economy. It related theoretical literature framework of our study would be analysed in the light of variable such as globalisation, ICT, education, human capital, social capital, and economy well being.

Introduction

Knowledge and technological innovation play a crucial role in economic activities in parallel with the technological infrastructure recognized by managers, scientists, and engineers, together with the related telecommunications, information systems, environment, microelectronics machinery and computer-based transportation. As it could be easily seen, technical progress has direct effects only on production. Through process or product innovation, it is evident that to maintain a kind of feedback on education and human capital formation is the natural result of the investment inputs closely connected with the scholastic fashion. Education and technological change are major determinant of economic, cultural, political, social, and demographic changes. It must be born in mind that considering the global aspect of the economic system, one should emphasize the importance of the inclusion of information and communication technologies (ICT) in education, which naturally results in the productivity of education outputs, and well-being.

The purpose of this study is to conduct a theoretical review on the role of education and ICT in economic growth and development. The first of the study is focused on the importance of education, globalization, and human and social capital in time. The contributions and the opportunities provided by the ICT on the process of education were examined. Subsequently, the increase in the output of education provided to the economy, and its contribution to the inventories of human and social capital were highlighted. Then, the impacts of the increase in the output of education, on the increase of human and social capital, and consequently, the enhancement created by all these factors on economic growth and development, were examined in detail on a theoretical platform.

Importance of Education

An education is based on scientific humanism, which focuses on the use of technological and scientific advances to enhance the welfare of humans and democracy. Unlike many later statements, education for scientific humanism is worth reading because the emphasis is on individual control and benefits (Spring, 1998: 206). The concepts of human capital and human resources render education primarily instrumental to economic prosperity (Spring, 1998: 6). These concepts dehumanise people and place them in the same category as raw materials such as minerals.

Education is supposed to solve the problems of knowledge-based economic growth, unemployment, reduction of poverty and increasing inequality in wealthy, better health and alleviation of population pressures, more effective democracy and political stability, lower crime rates, sustainable environmental quality, and the social and personal disruption caused by constant technological change (McMahon, 1999: 270). All are vital aspects of true development. All are also fundamental to the quality of life for individual families and hence too human welfare. The proposed solutions are to (Gradstein, 2005: 3):

- Building human capital by teaching skills that directly enhance productivity,
- Providing screening mechanism that identifies ability,
- Building social capital by instilling common norms of behaviour, and
- Providing a consumption good that is valued for its own sake.

Education is considered a part of a collaborative dynamic process to enable growth and development in support of a modern inclusive society (Ottersten, 2004:144). Education is a key driver in the creation of knowledge to accelerate diffusion and encourage innovation. Hence, education and training will have both direct effects in the market and indirect effects in the build up of research and development and implementation of innovation.

The generally accepted results, determined as the result of various studies that were conducted on the economies of the developing countries pertaining to the effects of the learning and education process on the economy, are outlined as follows (Gümüş, 2005, 30):

- While the rate of return declines during the period of investment on the learning and education process; in time, as the outcome of the learning and education process, the rate of return increases both within the relevant countries, and as well as among the different regions of the concerned countries.
- In developing countries where the human resources consisting of skilled labour are scarce, the level of education that yields the highest rate of return is the level of primary education.
- Developing countries allocate “between” 1.4% to 10.4% of their national income to investments concerning learning and education in order to improve the level of skilled labour.
- In sectors that demand skilled labour, opportunities for on-the-job training create a reduction in the labour costs as the result of the enhancement of learning experience; hence the increase in the efficiency helps development grown. Meanwhile, the standpoint of the employees, on-the-job training provides opportunities for more rapid salary increases.

Concurrent with the advancement of technology, skilled labour becomes more efficient. Investments in training and education in the areas that are needed by the sectors operating in the economy enhance the capacity of the individuals in creating and using knowledge by using physical capital, and through this way, the new inputs are both harmonized and used in an effective manner, and the efficiency is enhanced in all sectors.

Educations and Globalisation

Globalisation provides a backdrop for analysing economic and social changes and concomitant changes in the education and learning sector. The globalizing education and learning economy are two most significant aspects of contemporary economic and social life. On the one hand, there is growing agreement that knowledge is now at the very core of economic welfare and development. On the other hand nations, regions, industries, and firms with a faster rate of growth are those, which more successfully manage to generate and apply knowledge. The crucial role of knowledge is now preached by a variety of academic, business, and policy sources (Archibugi, 2001: 1).

A global economy requires governments to develop a new approach, not only to trade fiscal policies but also structural policies. As the scope for state intervention in the economic sphere has become more and more constrained, policy makers have increasingly had to shift their attention to the ‘residual’ factors in the production function, principally technology and human capital (Tuijnman, 2003: 472).

It is important to emphasize how the ‘education and learning’ economy and the ‘globalizing’ economy are strictly connected (Archibugi, 2001: 2). It is obvious that knowledge and learning have always been a crucial component in human systems. It is connected to the opening of new scientific discoveries and technological innovations. A circular process has taken place. On the one hand, the development of an integrated world economy has allowed the acquisition of information, expertise, and technology at a faster pace and often at lower costs than in the past. On the other hand, the current phase of globalisation has been nurtured by a generation of new technologies. The major technological advances of the last quarter of a century have in fact occurred in fields, which allow the production, communication, transmission, and storage of information. ICTs have, in other words, acted as the material devices to allow globalisation to occur. Finance, production, media, and fashion would not be as global as they are today without the generation of new technologies. In this

sense, the ‘education and learning’, and ‘globalizing’ dimension of the world economy strongly reinforce each other.

Global economy is dependent on the quality of education, whereas the goals of education are dependent on economy (Spring, 1998: 6). Under these circumstances, education change as the requirements of economy changes. As a result, human capital theory now dominates discussions of education for the global economy.

Human and Social Capital

Human capital theory amounts to the proposition that education or training can be regarded as investment with future material pay-offs, analogously to investments in physical capital (Ashton, 1996: 14, OECD, 2001: 11, OECD, 1998: 9). Education policy based on human capital concepts can address only to the first in this list of causes of economic inequality (Spring, 1998: 225). It is economic promises, education policies based on human capital theories. Human imagine being income and profit making machines. Human value is defined by an individual’s worth in the labour market. The value of education becomes a function of human worth as measured by income.

Social capital is simultaneously an economic, sociological concept. ‘Social’ and ‘capital’ bring together the key terms in the disciplines of sociology and political economy (Szreter, 2000: 57). A satisfactory definition therefore involves the language of both of these disciplines. One narrow meaning of social development is public welfare policies of health, communicative, social security, and housing (Pieterse, 2004: 123, Szreter, 2000: 69).

The relationships between social capital and human capital are theoretically important. Some scholars have proposed that social capital helps produce human capital (Lin, 2003: 97). Well-connected parents and social ties can indeed enhance the opportunities for individuals to obtain better education, training, lifelong learning, and skill and knowledge credentials. On the other hand, it is clear that human capital induces social capital.

Table 1: The Relationship between Human Capital and Social Capital

	Human Capital	Social Capital
Focus	Individual	Relationships
Measures	Duration Qualifications	Membership/participation Trust levels
Outcomes	Direct: Income, Productivity Indirect: Health, Civic Activity	Social Cohesion Economic Achievement More Social Capital
Model	Linear	Interactive/Circular
Policy	Skilling, Accessibility and Rates of Return	Citizenship, Capacity-building, and Empowerment

Source: Field: 2000: 250.

There is a relationship between human capital and social capital. Human capital and social capital are not in direct opposition to each other, but they are theoretically and pragmatically in a relationship of tension (Field, 2000: 250-251). To summarise distinctive features of human capital and social capital, one should point to their complementarity of purpose and process, rather than to any strategic opposition. If human capital describes individuated economic capacities, social capital captures the quality of experience and the ways in which relations between individuals and groups shape it. If human capital assumes linearity, social capital is about interactive and circular relationships. Yet, there is ambiguity among scholars as to whether social capital should be treated as an independent force or an inseparable component of enquiry into selected aspects of capital with many facets. For some,

all behaviour are subordinated to the furthering of economically rational interests; others lament this as the essence of the individualised, reductionist and commodifying neo-liberal project. Some conceptualisations present social capital as a prevailing, if varying, condition and consequence of multiple activity domains, among which family, work, community, nation feature prominently (see Table 1).

The effects of human capital on the economic development can be classified under the following groups (Gümüş, 2005, 51-65): Economic Growth: [Enhancement of the efficiency of physical capital; increase of productivity; creation of new employment opportunities and the definition of the technological development and the effects of diffusion.], distribution of income, regional development and social capital.

The Contribution of ICT and Education to Economic Growth Technology Progress and Education

As the outcome of the emergence of global integration and the development of the knowledge-based economy, the importance of economic growth has increased within the process of economic growth.

Human capital enables the production and utilization of technological knowledge. Moreover, it facilitates the harmonization of the labour power within the technological development and contributes to the process of technological progress (Gümüş, 2005: 54, McMahon, 1999: 19-33). As the result of these developments, the productivity of human is further enriched. Human capital affects the economic growth and this situation creates the emergence of positive economic externalities. These positive externalities accelerate the economic growth. Countries that accomplish a higher rate of growth give further priority to the investments in human capital. This theoretical explanation is available in the literature concerning inner growth.

As the outcome of the emergence of positive economic externalities, technological development and the increase of efficiency and employment opportunities, the human capital becomes even more effective than the physical capital in economic growth (Gümüş, 2005: 55). In effect, an economic growth is accomplished, which is accompanied with the demand for qualified labour. These two economic factors interact and reinforce each other. Economic growth enhances employment opportunities, promotes higher wages for the employees and higher profits for the investors, encourages the investors and the governments to realize higher investments in human capital, and creates more abundant resources for the accomplishment of these purposes. Investments in human capital provide the necessary equipment for the creation of new employment opportunities for the labour force, and ensure a competitive edge for the global markets. All these effects facilitate and accelerate economic growth.

Information and Communication Technologies

Technology has evolved in the historical process through changes that formed consecutive epochs of development. When we examine the 'Industrial Revolution' in history, we mark that this process has evolved in history in three revolutions (Mokyr, 2002: 78-118, Warschauer, 2003: 13). The first followed the invention of the steam engine in the eighteenth century and was characterized by the replacement of hand tools by machines, mostly in small workshops. The second followed the harnessing of electricity in the nineteenth century and was characterized by the development of large-scale factory production. The third revolution came to fruition in 1970s with the diffusion of the transistor, personal computer, and telecommunication. 'Industrial revolution' is having a large impact on the word economy.

Like any other technological change, information technology is expected to increase productivity, enhance the quality of life, reduce price, and create new economic activities and new employment opportunities as well as generate wealth. It has also often been presumed that this impact can be beneficial to all countries, regardless of their level of development. Computers and other information processing equipment have been much smaller than that of the railways some 100 years ago (see Table 2).

Tablo 2: The Three Industrial Revolutions			
	First Industrial Revolution	Second Industrial Revolution	Third Industrial Revolution
Beginning	Late 18th century	Late 19th century	Mid-to-late 20th century.
Key technologies	Printing press steam engine, machinery	Electricity, internal combustion, telegraph, telephone	Transistor, personal computers, telecommunications, Internet
Archetypal workplace	Workshop	Factory	Office
Organization	Master-apprentice-serf	Large vertical hierarchies	Horizontal networks

The differences between the economies based on old industry and the new knowledge based economy are not only quantitative, but also qualitative. The world is undergoing a process of change not because the computer operators have replaced the secretaries and the typists all over the world, creating a substantial increase in efficiency, but rather because the human pursuits for survival and increase of welfare are now based on a completely different source of welfare. To the extent that agriculture based economy differs from the economy based on industry, the information technologies have created a radically different and innovative economy, which can be characterized as information based economy.

Today is information century. Historically, the dramatic rate of scientific and progress has taken place alongside two other epoch-making phenomena: economic growth and social and economic globalisation (Archibugi and Michie, 1998: 2, Pohjola, 2002: 10). Indeed, technological progress, growth, and globalisation describe the three most significant aspect of the long-term evolution of the world capitalist economy. These complex phenomena are obviously interrelated, although this does not mean that the linkages can be easily specified. On the contrary, the complex relationships between technical change, growth, trade, and education are still subject to debate and controversy despite the large body of theoretical and empirical research, which does exist. Production of information and communication technology good and services has contributed quite substantially to economic growth in many developed and newly industrialized countries.

ICT have altered the traditional learning environment by using new educational tools, that is to say, the concept of learning means the use of new multimedia technologies. In other words, the Internet improves the quality of learning by facilitating access to resources and services (Debande, 2004: 20). Thus, different strands which must be integrated into a comprehensive policy: infrastructure and equipment; high-quality educational multimedia services and content; training services and facilities for teachers and for lifelong learning; and dialogue and cooperation at all levels.

Four principal rationales have been identified to support the introduction of ICT in education (Debande, 2004: 20):

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- Social, based on the recognition of the role played by technology in society, the need for education to reflect the concerns of society and to demystify technology for pupils/students;
- Vocational, driven by the requisite of ensuring that the system is preparing students for jobs which require skills in technology;
- Pedagogical, linked to the fact that technology will assist the teaching-learning process through better communication and higher quality material and hence enhance the teaching of traditional subjects; and
- Catalytic, through external effects on society by improving the cost-effectiveness of the delivery of educational services; on the education system by reshaping the transmission of knowledge and the acquisition of skills for disadvantaged communities.

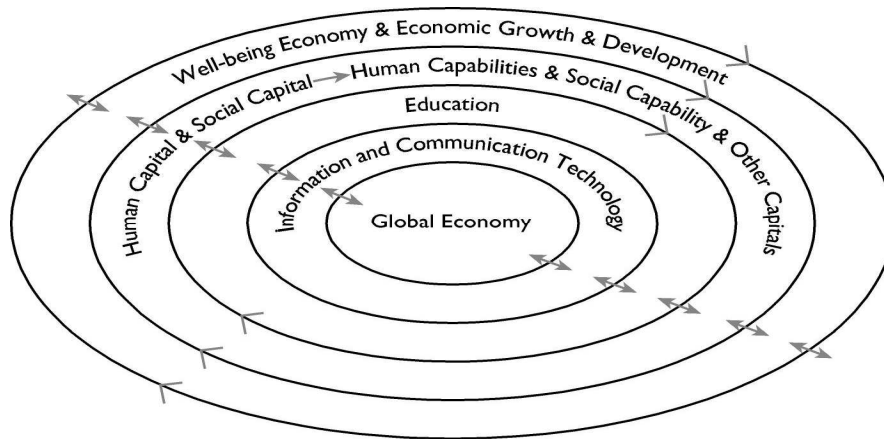
Critical comparative educators have shown considerable concern with the impact of globalisation on and through education. By this they means a number of things (King and McGrath, 2002: 282):

First, the growing complexity of development cooperation, taken with the rapid advances in ICT, requires a new way of organising and sharing internally the data, information and knowledge that agencies already have. Second, the growing emphasis on policy and programmes rather than projects makes it more important that the ‘agencies’ ‘partners’ can access the ‘right’ knowledge on which to base policy decision. Third, the wide acceptance of the language of partnership in development emphasises that policy decisions should (be seen to) come from national learning rather than donor conditional ties. Fourth, there is ‘developmentally useful knowledge’ that has been synthesised and which ICT can ensure could be spread quickly and effectively to the poor, hence reducing their interrelated poverty and ignorance. Fifth, knowledge systems in partner countries need to be strengthened to improve their economic success, poverty reduction and ownership of their development path.

This has been a practical discussion that has been shaped by debates on aid effectiveness and lessons from management studies, rather than by philosophical debates about the nature of knowledge or recent, largely anthropological, critiques of the knowledge approaches of development.

Today’s knowledge-based society is a broad concept related to the ongoing transformation process of production activities making knowledge more prominent as a factor of production and social integration (Ottersten, 2004:142). More broadly speaking, it simply reflects a society where there is a learning and knowledge process in each part of work and day-to-day life, thus building up human capital and regarding a stock of intellectual/intangible capital in products and services as the basis of the knowledge-based society. Open access to all knowledge generating, transforming and using activities for all citizens is considered crucial for social cohesion.

ICT intersect with the struggle for better education, and not always in ways that benefit marginalized learners (Warschauer, 2003: 152). The development of technology toward greater equality, inclusion, and access is in no way guaranteed but will depend in large part on the mobilizations, and communities to demand that technology be used in ways that serve their interests.

Figure.1. The Role of the Education and ICT in the Economic Growth

A rather simplified diagram showing an economic cycle is provided in Figure 1. Assuming that this economic cycle operates in the global economic system, and that the economic system possesses ICT; and assuming that in this economic system, we have mainly focused on the education variable, and have considered the other variables a constant values, it can be asserted that the economic cycle operates as follows: In global economy, an education output is yielded as the outcome of the process of education, which in turn, affects the capital of the country. In our figure, it has been defined as natural and physical capital as well as 'human and social capabilities'. Human capital represents the knowledge, skills and health embodied in individuals and social capital refers to the norms and Networks facilitating co-operation either within or between groups. Political, institutional and legal arrangements interact with human and social capital to influence well-being. Additionally, human and social capitals legal also have their worn direct links with natural and produced capital. The human and social capitals, which have a direct correlation with political, institutional and legal regulations, they play a complementary function for the conventional production factors in ensuring and strengthening of economic growth and development. The enhancement of efficiency and productivity as the outcome of the existing correlation between all factors of production and the effects of positive economic externalities has a critical importance in the accomplishment of both economic growth, and socio-economic development.

Conclusion

A backdrop for analysing economic and social changes is based on globalisation. Education and global economy are envisioned as having an interdependent relationship. Competition in the global economy is dependent on the quality of education, whereas the goals of education are dependent on economy. Under these circumstances, education changes as the requirements of economical changes.

Human capital enables the production and utilization of technological knowledge. Moreover, it facilitates the harmonization of the labour power within the technological development and contributes to the process of technological progress. As the result of these developments, the productivity of human is further enriched. Human capital affects the economic growth and this situation creates the emergence of positive economic externalities. These positive externalities accelerate the economic growth. As the outcome of the emergence of global integration and the development of the knowledge-based economy, the importance of economic growth has increased within the process of economic growth. That kind of service aiming at the well-being of the new generations who are far away from benefiting from the advantages of the new systems of education will allow them to make use of every kind of opportunity related to not only education but also other social aspects.

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